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Joensen, J.S. & P. Zachariassen

STATISTICS FOR PILOT WHALE KILLING IN THE FAROE ISLANDS

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Statistics for Pilot Whale Killing in the Faroe Islands

1584-1640 and 1709-1978

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Computer Data Preparation

INTRODUCTION

In the Sheep-letter (1298) there are regulations governing the landownwer's share of whales which are driven onto land. Then the landowner's share was three quarters. There is nothing to tell us which species of whale was driven onto land at that time. But it is most likely to have been the Pilot Whale, although we have no direct evidence that this was the case. Louis Zachariassen (1959) writes that the whale-hunt may have existed in this country back in the Middle Ages. H.C. Muller (1884) says that the Pilot Whale was known and hunted in this country as far back as antiquity. H.E. Høst (1875) writes that it cannot be fixed with certainty how long men have been hunting whales here. However, he does not believe that the whale-hunt was known around 1400. At about that time two Venetian noblemen, the brothers Nicolo and Antonio Zeno, were in the Faroes. The former was in the Faroes from 1390 until 1395, and the latter from 1391 until 1405. They wrote an exact account of their travels (printed in 'Historical Memorials of Greenland', Copenhagen 1845). Among other things, they wrote about the fishing, and they mentioned the Faroese exported fish to many European countries. Høst believes it inconceivable that the whale-hunt was known in the Faroes at that time, otherwise it would have been mentioned in the Zenos' account.

The whale-hunt is mentioned in other places by the great majority of older authorities writing on the Faroes. We will name only a few here, such as, e.g., Lucas Debes (1673), J. C. Svabo (1781-2, published 1959) and Jørgen Landt (1800). H. C. Müller (1884) writes of whales killed in the period 1584-1883. M. Degerbøl (1940) discusses the period 1904-39, and the whale-hunt from 1940 until 1962 has been covered by J. S. Joensen (1962).

THE COLLECTION OF STATISTICS FOR PILOT WHALE KILLING

Nearly all the older statistics, for the period 1584-1883, used in this paper are taken from Müller (1884). The first case that we can be certain about may well be the four whales that ran aground off Lítla Dímun in 1584. Otherwise Muller writes that the first school was killed in the northern part of the sound between Streymoy and Eysturoy in 1600. Louis Zachariassen, however, mentions two schools from before 1600. The first of these was killed in 1588 in Skálafjørður. According to the sheriff's records the king's share came to 23 whales from this school. Louis Zachariassen says that the king's share of this school was one fifth. Thus it can be calculated that this 1588 school contained about 115 whales. The second school came ashore in Klaksvík in 1599, and contained 90 whales. Both these schools were inadvertently omitted by J. S. Joensen (1962).

For the period 1641-1708 we know next to nothing about Pilot Whales (Gablatið). Still, Lucas Debes (1673) mentions that over 1000 whales

were beached in two places in 1664. Svabo (1781-82) says: "During the past hundred years many schools of Pilot Whales have been rounded up, more than in more recent times." But as we have already said, we have no general view of the schools which were killed in this period. Otherwise we have used Müller's figures for the period 1709-1883.

For the period 1884-1903 no complete statistics on Pilot Whales have yet been printed. We have tried to collect these statistics. Some of the data (records of whale-killing) were obtained from the National Archives and the Chief District Officers. We have also consulted the newpapers, especially Dimmalætting and Føringatíðindi (the latter from 1890 until 1901.) No school was killed in the years 1890, 1891, and 1901. Yet Dimmalætting and Føringatíðindi can tell of numerous schools sighted in 1890 and 1891, some of which were approached by boats, but it was not possible to drive them into a bay.

As we have said, M. Degerbøl has written about the years 1904-1939, and he has a list of the schools that were killed in the Faroes during these years. He takes the statistics from the year-book Fiskeri-Beretning, published by the Danish Ministry of Fisheries (formerly Ministry of Agriculture). We have investigated these statistics in order to consider them together with the records of whale-killing and information from Faroese newspapers, and Degerbøl has not tracked down all the schools and whales. For altogether nine years our figures are higher than the ones quoted by Degerbøl. In contrast there are five years where we have a little fewer whales than Degerbøl. The latter may arise from the fact that the Fiskeri-Beretning can have

figures for all whales killed during these five years, whereas the records of whale-killing include whales that have been distributed and do not accept the ones which are caught after distribution. Yet this cannot be the reason for the 1915 figures; Degerbøl says that 1199 whales were killed, but we only find 876. It is most likely that here is included a school which we have not yet come across.

The statistics for Pilot Whale killing for the period 1940-62 are available in Fróðskaparrit II (J. S. Joensen 1962). The material was obtained in order to investigate the records of whale killing according to the Chief District Officers' information also. Unfortunately these figures are not complete either. Later we came across a school which was killed in Klaksvík in March 1941. In July of that year two schools were killed on the same day, one in Tvøroyri and the other in Vágur. Both of them were distributed together and therefore were counted as one school. By rights they should most probably be counted as two. Also, in August 1960 a school which is not in the 1962 survey ran aground in Klaksvík.

After 1962 the Fishery Research Department has had statistics for Pilot Whales in the Faroes available for every year. These figures come directly from the Chief District Officers. The figures are published in International Whaling Statistics, published every year by the Bureau of International Whaling Statistics, Sandefjord, Norway, and elsewhere. All the statistics for Pilot Whale killing from 1709 until 1978 are entered into a database, and the discussion of the statistics and the figures for this article have been compiled with a computer (HP 9830) at the Fishery Research Department.

ASPECTS OF THE STUDY

From year to year the numbers of whales killed have varied, from nil up to 23 schools, with altogether 4,325 whales, in one year (1941). The same is true of the seasons, e.g., in 1911 there were ten schools, and all were killed in August, whereas out of fourteen schools in 1953 only one was killed in August. Different locations also show variation, e.g., altogether 237 schools were killed in Miðvágur as against 7 in Viðvík.

The schools also show variation; a few times only a single whale is killed, whereas in 1729 a single school in Klaksvík had 1,184 whales. We will be looking at the various distributions and trying to point to the possible connections and touch on the factors which can be considered significant for this matter. For the most part, the investigation of the variations will embrace the period 1709-1978, thence we have information on all schools for 270 years in a row. Included will be statistics for Pilot Whale killing from the years 1584-1640.

PERIOD

During the period 1709-1978, 1,443 schools were killed with altogether 211,878 whales, that is on average 147 whales for every school. In Figure 1 the number of whales and schools in the given period is reproduced. 1941 was much the best year ever for pilot whales, and next came 1923 with 3,203 whales in fifteen schools. In third place was 1843,

with 3,143 whales in eighteen schools. The latter half of the eighteenth century was uniquely poor in schools; for fifteen years in a row (1755-1769), not one came ashore.

In Figure 2 are shown the line graphs which are obtained in order to average out the blocks in Figure 1 so that the average figure for a given year is obtained as a moving average, e.g., three years: the given year, the previous year, and the following year (example: in 1940 there were eight schools, but the averaged number of whales in 1940 is 15.3 (15 + 8 + 23)/3). A line graph with averaged numbers can make one more aware of the possible variations in the overall picture than can the original figures, for - as in this instance - there is an extremely great difference in the figures from one year to the next, and these sudden changes could disrupt the total picture.

The line graphs with the 11-year moving averages clearly show four great peaks spanning the years 1725-30, 1840-45, 1936-43 and 1955-65. Between the two latter peaks are some middling years, but taking them together we can count 1936-69 as one peak, and then an important trend is visible: there are 100-120 years between periods rich in schools. The figures for the period 1584-1640 show that the years 1614-21 were good whaling years according to conditions of the time. Although figures for the years 1641-1708 are not available, these earliest figures could give a hint of the main trend mentioned above: between the good whaling-years, 1614-21 and 1725-30 is a little over a century. The line graph with the three-year moving average shows in addition to the main trend - several smaller peaks where one or more extremely good whaling-years stand in

contrast to the years immediately before and immediately after. The period 1879-80, 1899, 1909-11, 1920-23 and 1931-32 are examples where such smaller peaks are to be seen.

Figure 3 shows first of all the distribution of years by the number of schools killed. For example, there are 22 years when five schools have been killed, and these years are spread throughout virtually the whole period. It is different with the 44 years when no schools were killed; 36 of them fall in the period 1748-1798. All the distribution can be seen as a combination of several distributions, when each comes from one period when the years as a whole were almost as good. An attempt at such an analysis shows that it was suitable to work with five periods, which were called A, B, C, D, and E. Figure 3 shows the respective distributions, and it is clearly visible that a variation in the moving average changes the shape of the distribution: a greater moving average gives a more symmetrical and, on the whole broader picture. Some key figures for the five periods are laid out in Table 1.

SEASONS

Table 2 shows the distribution of schools according to the month in which they were killed for the years 1709-1978 and periods A-E. Also the table shows the percentage distribution for schools and whales, and under each figure is given the moving average for whales in one school. The percentage figures for the distribution of schools are reproduced in Figure 4.

On aggregate, for all of the period 1709-1978 August is the best

month for Pilot Whale hunting with 29% of the schools (32% of the whales). Next is July with 21% of the schools (22 of the whales). The poorest month is March with 1.4% of the schools (1.3% of the whales). If we look at the distribution for the periods A-E, B should be treated with caution owing to the small number (21) of schools which were killed in those years. If we compare A, C, D, and E, we see that D is somewhat different. This is especially true for D in August, when 51% of schools (53% of whales) were killed during this period. A,C,E, resemble each other very much, especially in summer and autumn, June-Oct.; although winter and spring turned out better in E - 21% (19%) - than in A and C, 14% (11%) and 10% (8%) respectively. The distribution for B does not show any clear pattern, although it seems that in this very lean period schools come here as often in winter and in spring as in summer and autumn, which otherwise are the best seasons for schools. Taken together the monthly distributions show that the good periods A,C, and E resemble one another in that July and August are almost equally good with altogether about 45-50% (47-61%) and a symmetrical deviation to both adjacent seasons. During the years 1584-1640 12 and 8 schools ran aground in July and August respectively, out of a total of 41, i.e., about the same proportion as in the good periods. In D, a rather poor period, August is by far the best month, followed by September. In D June and July had only 11%(17%), in contrast to 31%-36% (33-35%) in A, C, and E.

For one part of the period E, 1951-1969, Figure 5 shows the month in which each school was killed. These years were very good for schools, on average 13 per year, so much so that the distributions for the single

years could give us a very good idea of the possible variations from one year to the next. The most distinct change seems to have been from 1962 until 1963. The years 1956-62 are very similar, around 50-60% the first seven months of the year, while the years after, 1963-65, have only 14% of the schools in the same months. From 1952 until 1953 also a change is seen; in 1952 only two out of nine schools came in the first half of the year, and in 1953 10 out of 14. From 1965 until 1969 an ongoing trend can clearly be seen towards a greater and greater number of schools arriving in the earlier part of the year, with the spread increasing simultaneously. In 1970 there were only three schools (April, Aug., Nov.).

WHALE BAYS

Figure 6 shows the distribution of schools and whales according to bay for the period 1709-1978. The sequence is laid out according to the number of schools, and the whale bays are marked on the map with the corresponding number. The majority of the schools came ashore in a small group of whale bays, thus 67% of the schools (74% of the whales) were in the six best whale bays. For bays nos. 1-16 the distribution by period is laid out in Table 3 (set down as Table 2). If one looks at the distribution for individual bays, a great difference is seen in the share which a given bay has in the various periods. In Miðvágur, e.g., C has 18%, in D 30%, and in E 10% of the schools killed. For Klaksvík the figures are 14%, 5%, and 13%. The figures for Vestmanna are 10%, 16%, and 6%, i.e., about the same proportional variations as for Miðvágur.

This can be a point in favour of making smaller groups out of whale bays, where whale bays in the same group lie in such a way that schools usually come from approximately the same direction. With reference to the table below such a combination has been put into four groups, one for each cardinal point.

West 1-5-11-18-20-24-26-27-30

North 2-8-10-14-16-22

East 3-7-12-15-19-21-25-28-29-32-33

South 4-6-9-13-17-23-31

Figure 7 has a "compass" which reproduces the percentage distribution in the four groups of whale bays for the periods A-E. In the diagram the number of schools from every direction is written for B instead of reproducing the percentage figures. The western group shows the greatest variation, has the smallest part of A (17%) and much the greatest of D (57%). The northern and eastern groups are somewhat similar to each other, the least part of both is in D (8% and 12%), and the parts range from 21% to 33%. To the south there is the least variation between periods, 21-23% in A, C and D and 29% in E.

The periods A-E differ in length and in number of schools, so in order to better see the trend in each site group a diagram has been put together, Figure 8, with yearly moving averages in the schools. From this diagram it can be seen that in the West there is not such a great variation between C, D, and E, between almost two and almost two and a half schools on average in a year. The greatest jump is in the North, where on average there was a school every fourth year in D, and almost

three a year in E. Otherwise, on the whole, the trend to the North, East, and South has been rather the same.

In addition to the month Figure 5 shows the distribution of schools in 1951-1969 in site groups. Very great differences can be seen. In the West the years 1951-55 were poorer than the years 1956-69, 13% and 26% respectively. To the East were only eight out of 79 schools (10%) in 1963-68, in contrast to 29 out of 100 schools (29%) in 1956-62. It can be seen that the sudden shift in the whale bay distribution from 1962 until 1963 coincides with the shift in distribution by season - the schools come later in the year in 1963 in contrast to the previous years.

During the years 1951-69 altogether 247 schools were killed with the following site group distribution: West 57 (47+10), North 72 (52+20), East 51 (39+12) and South 65 (61+4), where the first figure in the brackets gives the number of schools from April to September, and the second the number of schools from October to March. The difference is in the groups; especially to the South it goes down to only 6% from October to March, in contrast to the North, where 28% were killed at this time of year. This distribution pattern between whale bays and seasons has not been firm. The years 1938-43 were in this respect very different. The following was the distribution: West 14 (13+1), North 18 (14+4), East 12 (7+5), and South 32 (13+19) with the percentage figures 59% and 12% from October to March for South and North respectively. There is also a difference according to season in the site group distribution as a whole. In the period 1938-43 there were as many schools in the South as in the West and North put together, but in the period 1951-69 these three groups has almost the same number of schools.

SIZES OF SCHOOL

The dotted line graph in Figure 2 shows the moving averages of whales and the height of the line graph is set so that if all schools were the same size, the dotted line graph (whales) and the unbroken line graph (schools) would coincide. Thus it is seen in the diagram that for the years 1715-30 and 1810-20 there have been a good deal fewer schools than usual, while the large schools have occurred around 1840-50 and 1935-45. For all the years from 1868 until 1957 the whale-line has been higher than the school-line.

The figures in Table 1 for whales in each school point to the schools being on the whole smaller in periods with many schools than in periods with few schools. With reference to Figure 2 in D the schools are above average for virtually the whole period, but for C and E, the years of plenty, there is a very great difference in the size of schools.

Table 4 shows the distribution according to size for the period 1709-1978 and for A-E, and the percentage distribution is reproduced in Figure 9. D stands out the most, especially in the size of the groups containing 51-100 whales, where 12% of the schools are numbered, in contrast to 24-29% in the other periods. Schools with more than 300 whales are more common in D than in A, C, and E - 19% as against 7-11%.

The distribution of whale-bays in Figure 6 and Table 3 shows that the three best whale-bays have had substantially larger schools, with 174-178 whales on average, than bays no. 4-11, where the average is

101-148 whales. Bays no. 12 and 13 have seen large schools, with averages of 171 and 186 respectively. The cited shift in numbers of whales for each school from period to period (according to Table 1) is on the whole similar for each whale-bay in itself; thus bays 1-3 and 5 all have D as their best period (B is not treated). Occasionally really big schools have appeared 16 schools have had more than 600 whales, eight of them in Klaksvík, two in Miðvágur, and the rest in other bays. There have been 19 schools with 501-600 whales, seven of which were killed in Miðvágur and two in Klaksvík.

FACTORS WHICH AFFECT THE WHALE-HUNT

As with all other species of whale, the Pilot Whale is not a source of food for other animals. Therefore the question of how much food is available and how extensively it is hunted is crucial for the well-being of any species of whale. In particular, some species of Great Whale have been in danger of total extinction due to overfishing. No basic estimates have been made concerning the Pilot Whale, but with the knowledge we have of its variations in size and age there is nothing that would indicate that it has ever been seriously threatened due to hunting. This conclusion was reached by D. E. Sergeant et al. (1962) in connection with a major investigation of the biology of the Pilot Whale, which he carried out during the period 1954-59. The data were obtained from two whale-bays in Newfoundland, where whale-oil was produced from blubber

during the summers of 1949-61. The best years were 1956-58, when, on average, approximately 8,000 whales a year were driven onto dry land and slaughtered (that is, about twice as many as in the best years in the Faroes).

The whale-hunt has never been a primary occupation in the Faroes. In most cases it is a question of schools which have been sighted by chance either from the land or from boats and ships which are at sea on other business. Sometimes searches have been carried out for schools, especially in olden times. Thus, unlike the fishing industry, whaling is not an essential part of the catch (number of boats and days spent fishing). Nevertheless there is an indirect connection between these two types of hunting: the growth of the fishing around the islands increases the possibility of seeing a school of whales.

THE EFFECT OF HUMAN ACTIVITY

Nearly all the types of human activity which have affected the whale-hunt through the years can be divided up into parts according to whether they have to do with population growth, changes in occupation and technological progress. This division into groups is considered suitable, although they are interdependent, so to say, e.g., technological advances can change occupations as much as population growth can. On the whole, these factors cannot be measured quantitatively; it is shown at once that they and the related circumstances must have continued to be significant to a greater or lesser degree.

Over such a long period as we are discussing, one may ask whether

changes in Faroese customs (such as eating habits and thoughts on the whale-hunt) have significance. In any case, since around 1600 there have been no signs of any changes in this matter. It goes without saying that more salted and dried whale was eaten formerly than is eaten now, with the better methods of storage that we have (refrigeration). The interest in whale-meat is still great. The renowned enthusiasm of the Faroeman when he hears 'Grindaboð!' has perhaps weakened in recent years, but he is doubtless used to there always being an excess of men and boats for both driving and killing.

Population Growth: Around 1700 it was estimated that about 4,000 people lived in the Faroes. The figures for 1800, 1850, 1900, and 1950 are approximately 5,000, 8,000, 15,000 and 32,000 respectively. It is obvious that this increase in population has in itself increased the possibilities of a school being sighted. Nevertheless it is a long way from the proportional growth in the numbers of schools being as great as that of the population; since 1600 only a few settlements have been founded, so that it is not a case of sightings from more places on land, but that sightings have been made more often from the same places.

The extremely great change in the distribution of whale bays in various periods (Figures 7 & 8) cannot be shown to be connected to the growth in population; the proportional growth in population has had, on the whole, been even in various parts of the country.

Changes in Occupation: In the seventeenth and eighteenth centuries the Faroes were a farming community in stagnation, the main exports were wool products, and fishing was done for virtually only personal use. In

the first half of the nineteenth century things changed, fishing gained an increasing significance and around 1900 the majority of exports were fish. This change brought others in its train, e.g., that in these years the number of boats and ships greatly increased, and the increased sailing around the islands has made it possible to see more whales than before. In the past twenty years travel between the islands, both by land and sea, has greatly increased, and this has also had an effect; e.g., it has happened many times that a ferry-boat has found a school.

Technological Progress: J. C. Svabo (1781-2) writes about the lack of equipment on a whale-hunt: "I noticed especially the greatest lack of these lances in Suðuroy, indeed, not long ago, a school is supposed to have come into one of the bays of that island, but due to the lack of suitable weapons it could not be killed; the smith is said to have rushed into the forge and got three ready, but meanwhile the school had got away." The principal reasons were doubtless that few schools had come this way (period B) and a possible shortage of iron. After 1800 it scarcely could have happened that men could not have killed a school because of shortage of equipment. The earliest regulations governing whaling (1832) required, among other things, some boats in each whale bay to be equipped for whaling.

In addition to the growth in the number of boats in the nineteenth and twentieth centuries, the fact that whaling boats have had motors installed has had a great influence. The earliest ones were the so-called 'motors' (10-15 tons) around 1910-20, and later came the more advanced motor-boats in the 1920's. The motor-boats were a great help

for the chase itself when a school was sighted far from land, although they did not take part in the kill.

When a school is sighted, it is important to announce this as soon as possible, so that it should not escape. Back in the seventeenth century we know that sightings were announced with a beacon. Svabo says that they hoisted a garment to a mast when the boat sighted a school. The first telephone lines between the villages were laid in 1905-06, and by 1925 there was scarcely a settlement which did not have a telephone. It is obvious that this method of communication has made it much easier to spread news of a school throughout the villages. It is the same at sea, when the first ships were provided with radio-telephone immediately after the Second World War, and the smaller craft a little later. Up until then it had often happened that a boat had come close to a school and not been able to give its position and in the end been finally forced to abandon the school because of bad weather or darkness.

The Effect of Natural Forces

These factors can be divided into two groups: those which indirectly affect the size of the catch and those which affect the basic feature (or features) of the school, such as composition and migration. Here 'indirectly' will be taken as natural circumstances which influence peoples' chances of seeing or driving whales. That is not to say that the circumstances named in the second group have a direct influence - too little data has been obtained on these questions for that.

The Effect on Opportunities for Hunting: On the shortest and longest days of the year the sun is up for 5 and 19 1/2 hours respectively. For some ten hours of the difference, people are mostly awake, and this means that the time for sighting whales is round about three times as long in midsummer as in midwinter. The weather plays a part also, especially for the small boats, thereby influencing the chances of seeing and hunting whales. The former factor is regularly bound to the seasons, and fluctuates from year to year. The latter factor is connected with the seasons to a certain degree, but can have varying significance in different years. On the other hand the sea currents are virtually the same year after year; they are not connected to the seasons, but have a significance for the fishing conditions. And therefore the number of fish also have an influence, of course.

The Effect on the numbers of whales: The Pilot Whale is a mammal, and on its life cycle we have the following from Sergeant et al.: the she-whale becomes sexually mature at six and the male at twelve, the gestation period is 15-16 months (1 calf per birth), the percentage giving birth is 10-13%, about 94-95% of the whales live longer than eight years, and some reach the age of 40 or 50.

Changing conditions in the sea from one year to the next can significantly alter the size of a year's catch of fish. This is valid for the Pilot Whale, but not to the same degree. Over many years there are great changes, and that can be seen to effect the breeding. We do not think that the main cause of conditions for the Pilot Whale being so varied is breeding, rather the Pilot Whale's migration patterns.

We must take into account the fact that in winter, when few or no schools are in our vicinity, the schools remain in the south. Doubtless the reason for the migration this way was first and foremost to search for food, which for the most part is the cuttlefish Todarodes sagittatus. The years when many cuttlefish have been obtainable have also usually had many schools, e.g., in August of this year (1979) ten schools were killed at the same time as many cuttlefish were being found. In some places it is about 15 years since a similar abundance of cuttlefish was found, in spite of the years being poor for cuttlefish they have been good for whales.

The degree of warmth and salinity in the sea has an effect on the life there. This has been measured many times in the North Atlantic. In particular the surface temperature has been measured in several places for some hundred years. Figure 10 is from J. Smed (1978) and reproduces a line with averaged numbers for the surface temperature (the moving average is 5 years), with measurements made at Tórshavn (1876-1921) and Mykines (1914-1969). Taken as a whole these figures show the same trend through the century as measurements elsewhere in the North Atlantic (50-65° N, 10-50° W): the low peaks are in the early 1880's and mid 1890's and the early 1910's; the high peaks are in the early 1940's and around 1960. If we compare this trend with the trend in the statistics for number of schools (Figure 2) there is an extremely good correlation, especially with the low point just after 1910 and between the two high points.

For the period 1957-76 C. Stougaard-Nielsen (1978) has figures for the surface temperature every quarter in one zone, 55-63° N, 2-42° W, divided into 18 areas. The number of schools for the period July-September for the past twenty years has been compared with the surface temperature in the same quarter in these 18 squares in order to work out the correlation coefficients marked by R in Figure 11. Also the figure shows the moving average (M) and the standard deviation (S) in the surface temperature. When R in Figure 11 is greater than 0.5 the correlation is so very good that it can hardly have happened by mere chance - otherwise the correlation is better the nearer R is to 1 (a correlation coefficient is never greater than 1). Especially to the south-west of the Faroes, areas 5732-5716, there is a good correspondence between number of schools and the surface temperature, where the R-figures are between 0.68 and 0.74.

In Figure 12 the surface temperature in the area containing the Faroes (6108) and area 5732 is contrasted with the numbers of schools for the same months and years. The good correspondence in area 5732 comes clearly into view; in nine years the temperature was less than 10.6 on average and during these years there were fewer than ten schools in the period July-September, while 10 of the twelve years had eight or fewer schools.

From 1966-69 until 1970-74 there was a shift in climate (which included air pressure and the temperature of the sea) and in life forms in the sea (including plant and animal life) in the North Atlantic. (D. J. Garrod et al., 1978). Some of the important statistics on schools for

this period are given in Figure 5. A significant change is taking place, and if a comparison is made with periods A-E it can be seen that the years 1966-69 are similar to the good period E, while the years 1970-74 are more similar to the tolerably good period D.

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